



## NASA SBIR 2012 Phase I Solicitation

### H8.02 Ultra High Specific Energy Batteries

Lead Center: GRC

Participating Center(s): JPL, JSC

Advanced rechargeable batteries are sought for future NASA missions.

For near-term missions, advanced lithium-ion (Li-ion) systems are being developed with the goal to achieve 265 Wh/kg and 675 Wh/L on a cell level. Advanced cathodes are sought, which when integrated into a full cell with a silicon-carbon composite anode, can enable a Li-ion cell to achieve the stated goals at practical voltage levels at a C/10 discharge rate when operating at 10 Å°C. The cathode should retain 80% of its initial capacity after 250 cycles. In addition, because the cathodes must be manufactured practically, cathodes must achieve a tap density of >1.5 g/cc, should possess qualities that can enable loading of at least 15 mg/square cm per side, and should utilize synthesis approaches that are readily scalable and are amenable to large scale electrode processing utilizing standard battery component equipment. The anode will achieve a reversible capacity of 1000 mAh/g and operate between 50 millivolts and 1 volt versus lithium. The cathode should have no detrimental impact on anode electrochemical performance, cycle-ability or cycle life, should possess a high degree of thermal stability, should have low toxicity, and should be stable against typical carbonate-based electrolytes at voltage levels and material loadings that are practical for the proposed system.

For far-term missions, proposals are sought for advanced next generation rechargeable chemistries that go beyond Li-ion and have the potential to offer >500 Wh/kg and >700 Wh/L on the cell level. Advanced next generation chemistries will be required for human missions, therefore specific energy and energy density goals must be met while simultaneously delivering a high level of safety. Applications may include Extravehicular Activities (spacesuit) and robotic landers and rovers for missions to outer planets, moons and asteroids.

Phase I proposals must include analysis and numerical/quantitative evidence to justify the choice of cathode or advanced chemistry that clearly shows how the proposed component/system has the potential to meet the projected specific energy and energy density goals at the end of a Phase II effort. Additionally, Phase I proposals should describe the technical path that will be followed to achieve the desired specific energy and energy density.

Technology Readiness Levels (TRL) of 4 or higher are sought.

Potential NASA Customers include:

- *Technology is cross-cutting* &#150; applicable to any mission or application that requires low mass, low volume, safe batteries. Some examples:
  - Office of Chief Technologist.
  - Human Exploration and Operations Directorate (EVA suits, landers, rovers, habitats, vehicle power).

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- Aeronautics Research Directorate (electric aircraft).
  - Science Directorate (power for payloads).